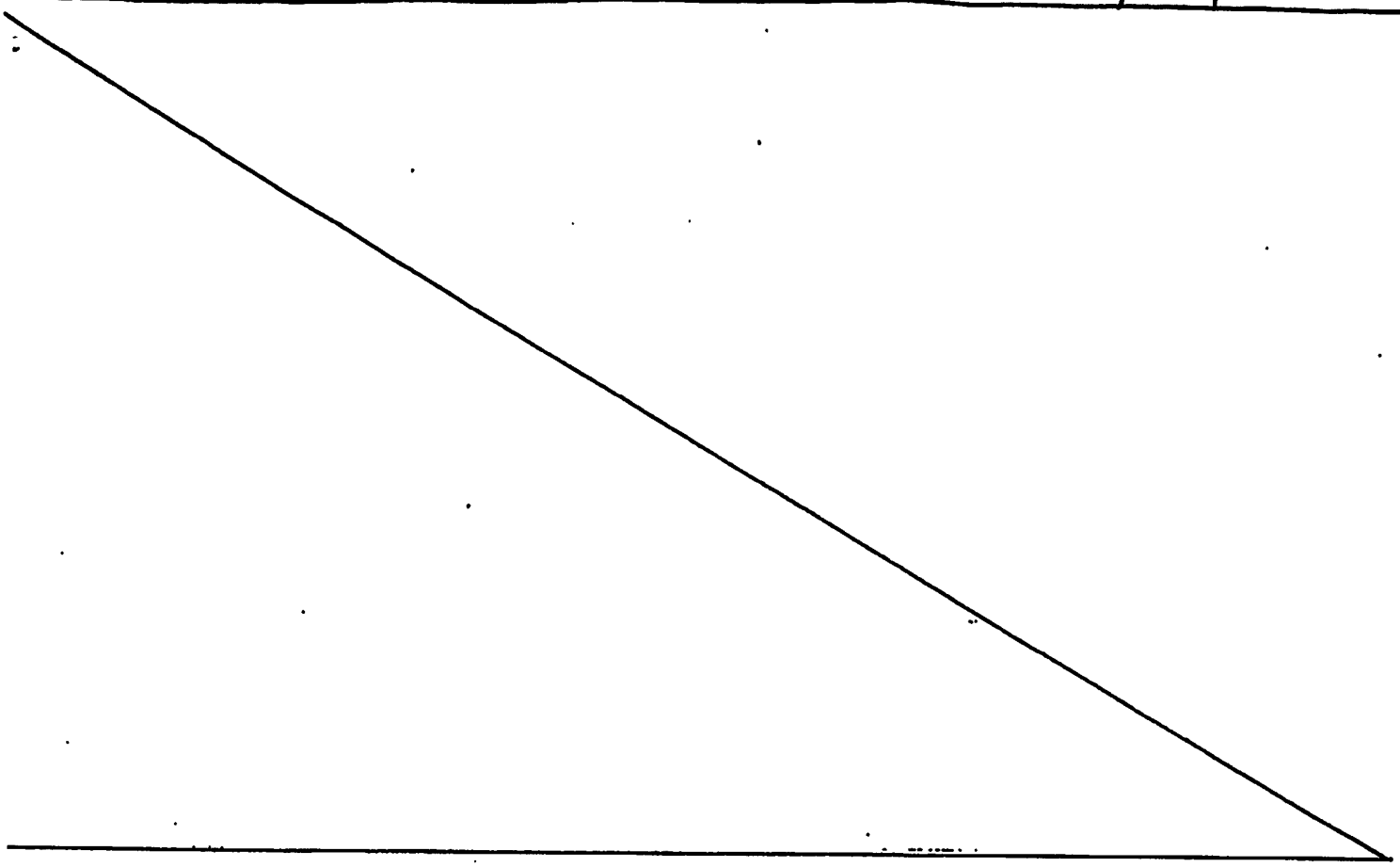
limit value) no longer increases to reach the control center value (FIG. 7B). Then, even though the battery pack is considerably charged, the battery ECU 116 determines that the representative SOC has not increased to the control center value. Therefore, the battery ECU 116 does not output to the HVECU 118 an indication that the SOC has increased to the control center value, and the HVECU 118 does not command the load 120 to stop the charging operation. If this event happens, the charging of the battery pack does not stop but inconveniently continues. In some cases, for the continued charging, the engine cannot be stopped. In some other cases, a hunting phenomenon of repetitive alternation between the charging and the stop thereof may occur. Furthermore, during a run of the vehicle, as it is determined that charging is incomplete despite accomplishment of practically maximum charge, the engine power is consumed for the charging of the battery pack 112 by the generator in addition to the driving of the vehicle by the vehicle-driving motor. Hence, there occurs a case where during a run of the vehicle that requires increased power, for example, an uphill run or the like, sufficient energy cannot be supplied for the driving of the vehicle, thus failing to meet a drivability requirement.

Another method and an apparatus for determining a battery's state of charge is known from US 6,359,419 B1. The method includes determining a current-base state of charge measurement based on coulomb integration, determining a voltage-based state of charge measurement based on the resistance of said battery and a hysteresis voltage, and combining the current-based state of charge measurement and the voltage-based stated of charge measurement to generate the state of charge measurement of the battery.

Further, EP 0 967 108 A1 discloses a battery control apparatus for a hybrid powered vehicle having a voltage detector that detects the voltage levels of battery blocks of a battery set. A presence of an overdischarged cell is detected when a voltage difference between each of the battery blocks reaches or exceeds a predetermined value. At this point, a battery ECU sets the SOC value of the battery set at the lower control limit value. This triggers an HV ECU to control the load such that charging is effectuated in the battery set. If further discharge occurs, the battery set is disconnected from the load by a relay.

EP 0 909 001 A2 also discloses a method and a device for detecting a state of charge of a battery assembly, and a battery assembly charge and discharge control device. Specifically, a variation of the charged amount among battery blocks comprising a battery assembly is detected. By subtracting the detected value of the variation from the width between the upper limit value and the lower limit value of the charged amount, the moveable range of the charged amount is found. The position of the present charged amount is detected as the state of charge. For example, it is arranged that both ends of the movable range are 0% and 100%, and that the movable range is the full scale. Then, the position of the charged amount on this scale is specified by the ratio %. The detection of the state of charge in which the variation in charged amount and the change of the movable range are considered, is performed, and on the basis of this state of charge, a preferable charge and discharge control is performed.



## SUMMARY OF THE INVENTION

**[0010]** The invention has been accomplished in view of the aforementioned problems and the like, and provides battery control apparatus, method and program and a battery control system for a battery pack which are capable of controlling the charge/discharge of the battery pack with improved accuracy despite capacity differences (capacity variation).

**[0011]** In accordance with an aspect of the invention, a battery pack charge/discharge control apparatus for controlling charge/discharge of a battery pack that is formed by combining a plurality of unit batteries of a secondary battery type, is characterized by comprising: charge/discharge restriction means for restricting the charge/discharge based on at least one of a capacity upper limit value and a capacity lower limit value of the unit batteries constituting the battery pack; remaining capacity detection means for detecting remaining capacities of unit batteries constituting the battery pack; control value computation means for computing a control state-of-charge value based on at least one of a minimum value and a maximum value of the detected remaining capacities; capacity difference computation means for computing, as a capacity difference, a remaining capacity difference between the remaining capacity of a first unit battery and the remaining capacity of a second unit battery among the unit batteries whose remaining capacities have been detected, the remaining capacity of the second unit battery being less than the remaining